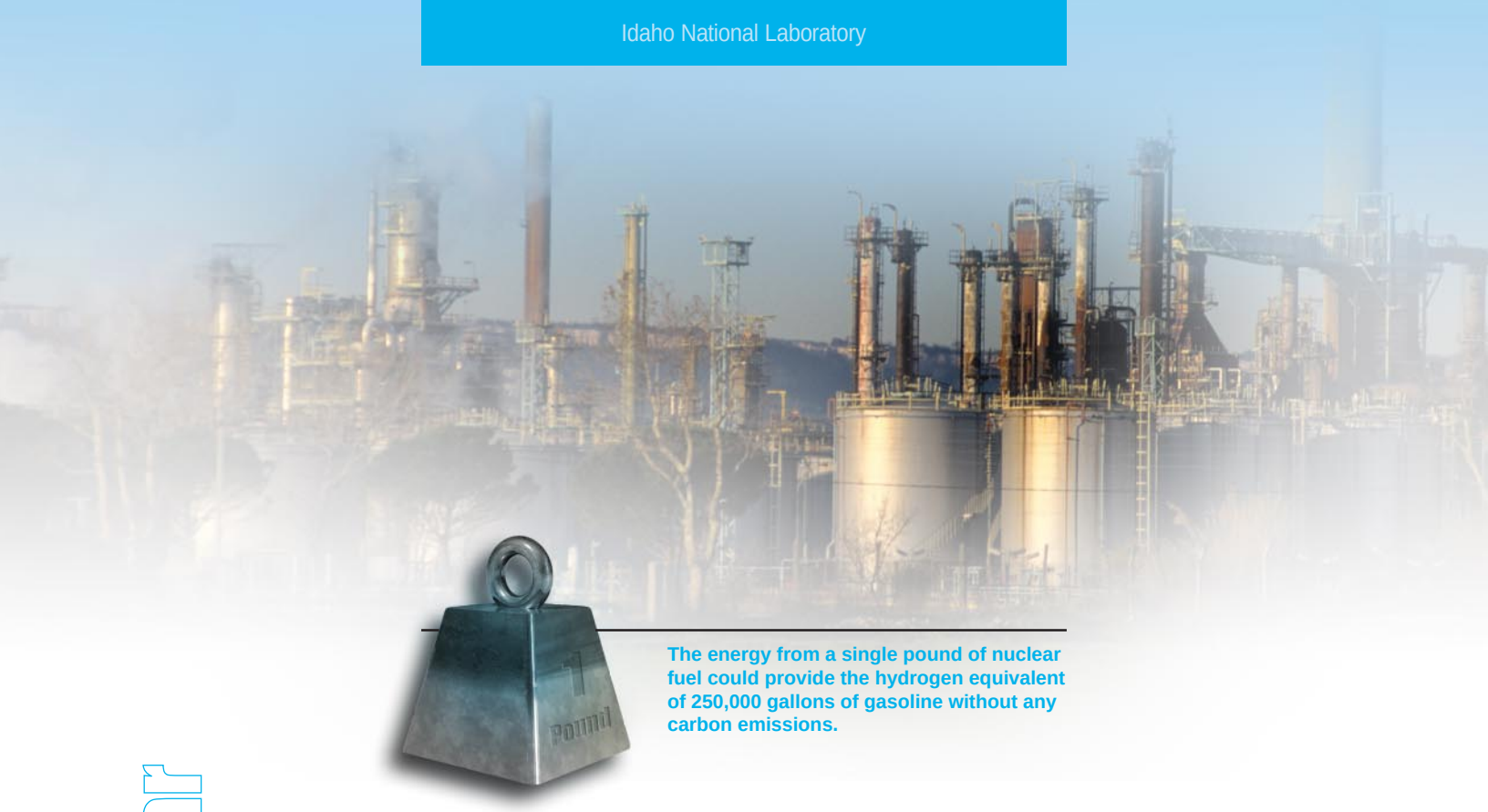
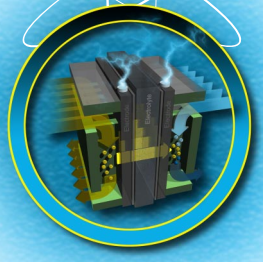


The energy from a single pound of nuclear fuel could provide the hydrogen equivalent of 250,000 gallons of gasoline without any carbon emissions.

Advancing the Nuclear Hydrogen Initiative



Producing Hydrogen with Nuclear Energy

Why Hydrogen?

A major initiative is underway in the United States to develop hydrogen into a major transportation fuel. The long-term goal of the Department of Energy's Hydrogen Fuel Initiative is to encourage the production of hydrogen-powered vehicles and the hydrogen supplies necessary to fuel them. The Idaho National Laboratory is taking a leading role in making this goal a reality.

A shift to a hydrogen economy would have dramatic environmental and economic benefits. Hydrogen-powered cars and trucks would emit no carbon dioxide or other harmful gasses into the atmosphere. A shift toward hydrogen and away from petroleum as a transportation fuel will also reduce U.S. dependence on foreign energy supplies. Changing the fuel cars and trucks use has huge potential: the transportation sector now accounts for 28 percent of U.S. energy consumption, and transportation energy use is growing faster than electricity or heating.

Why Nuclear Hydrogen?

Producing hydrogen requires enormous amounts of electricity and/or heat. Relying on fossil fuels for the energy to produce hydrogen would mean substantial new emissions of carbon dioxide. Using nuclear energy to produce hydrogen, however, would involve no CO_2 emissions. The energy from a single pound of nuclear fuel could provide the hydrogen equivalent of 250,000 gallons of gasoline without any carbon emissions.

Creating the Technology

Research is underway on several methods for hydrogen production using nuclear energy:

- ***Electrolysis*** to split hydrogen from water using nuclear-generated electricity.

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INL Idaho National Laboratory

In implementing its hydrogen initiatiive, the INL uses its research and applied engineering capabilities and its own and its partners' operations infrastructure to move forward on all of the technological underpinnings of the hydrogen economy.

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- *Thermochemical cycles* that combine heat and chemical processes to split water into hydrogen and oxygen.
- *Hybrid cycles* that combine thermochemical and electrolytic steps.
- *High-temperature electrolysis* adding high temperatures to the electrolysis hydrogen separation process to increase efficiency.
- *Steam methane reforming* using nuclear energy to generate the heat for the reaction (steam reforming of methane accounts for almost all hydrogen production today).

INL Is Making it Happen

INL is a leader in moving the hydrogen economy toward reality. INL's hydrogen initiative uses INL's portfolio of research and applied engineering capabilities and projects and its operations infrastructure to move forward on all aspects of the hydrogen economy: production, storage and use.

- *Production* – INL has research projects underway on high-temperature electrolysis and thermochemical cycles for water splitting, two of the most promising technologies for nuclear hydrogen production. A new Very High Termperature Reactor could be operating at INL around 2015, producing both electricity and hydrogen.
- *Storage* – INL is working on several aspects of hydrogen storage, including creating storage tanks that hydrogen cannot permeate, developing an aqueous solution allowing a safe and convenient source of hydrogen on board a vehicle, and creating new materials to increase the amount of hydrogen that can be stored on a vehicle.
- *Use* – INL is involved in research on fabrication of hydrogen fuel cells, developing a hydrogen fueling station and hydrogen-powered vehicle testing.

For More Information

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The INL is one of the U.S. Department of Energy's multiprogram national laboratories, and is managed by Battelle Energy Alliance, LLC.